Structural evolution of the Reserve graben, New Mexico: Extensional tectonics at the junction of the Rio Grande Rift, Basin and Range, and Colorado Plateau

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Acknowledgements

Funding
• New Mexico Geological Society
• Four Corners Geological Foundation
• Anton & Anita Budding Graduate Research Fund

Graduate Committee
• Jolante van Wijk
• Gary Axen
• Dan Koning

New Mexico Geochronology Research Laboratory & NMT EES students
Geologic setting

[Map showing geologic features such as the Colorado Plateau, Southern Rocky Mountains, Mogollon Plateau, and Southern Basin and Range.]
Motivation & Objective

• Determine how well existing regional tectonic models apply to the Rio Grande rift-Basin and Range transition zone, and refine these models

Change in extension direction: e.g. Aldrich et al., 1986; McQuarrie & Wernicke, 2005; Morgan et al., 1986; Liu et al., 2019
Fault kinematics: Striations & slip-sense indicators
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San Francisco Mountains fault zone – Pueblo Creek

- Primary slip surface
- R-shears
- Silica veins (tension fractures?)
- S-foliation
Fault kinematics: Striations & slip-sense indicators

San Francisco Mountains fault zone – Pueblo Creek

All planes and striations

- Striations
- Primary slip surfaces
- Rf shears
- Silica veins (tension fractures?)
- S-foliation

Average planes and striations

- Average striations trend (n = 13)
- Rf shears (n = 5)
- Silica veins (tension fractures?) (n = 3)
- S-foliation (n = 7)
Offset markers?

- ~4 km of apparent right-lateral offset of Ngli
- No apparent lateral offset of Ngmr
- Right-lateral slip continued past ~14.7 Ma?
- No apparent left-lateral slip
Regional tectonics

• Shift from mostly right-lateral to mostly dip-slip consistent with change from NE-SW to ESE-WNW extension in middle Miocene
• This change may have occurred here after 14.7 Ma

Change in extension direction: e.g. Aldrich et al., 1986; McQuarrie & Wernicke, 2005; Morgan et al., 1986; Liu et al., 2019
Conclusions

• Subsidence initiated around 16.4 Ma, ended before ~1.9 Ma
• Transition from mostly right-lateral slip to mostly normal dip-slip on graben’s master fault
• Possibly up to 4 km of right-lateral slip after 14.7 Ma
• Slip history may reflect regional shift from SW- to W- or WNW-directed extension
Questions
$^{40}\text{Ar}/^{39}\text{Ar}$ geochronology

1.89 ± 0.01 Ma

15.97 ± 0.03 Ma

16.35 ± 0.04 Ma

16.02 ± 0.04 Ma